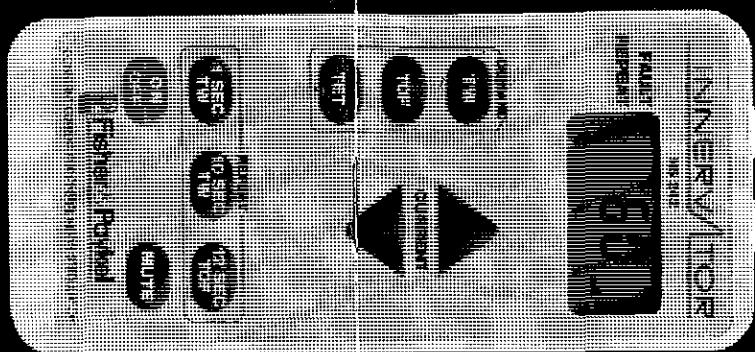
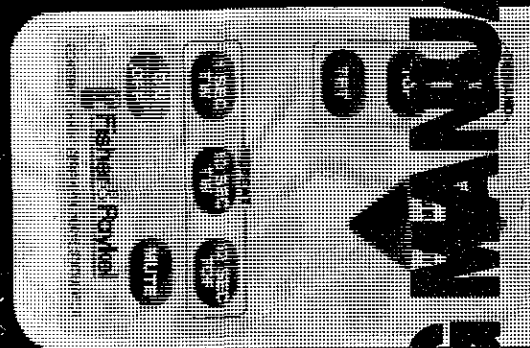
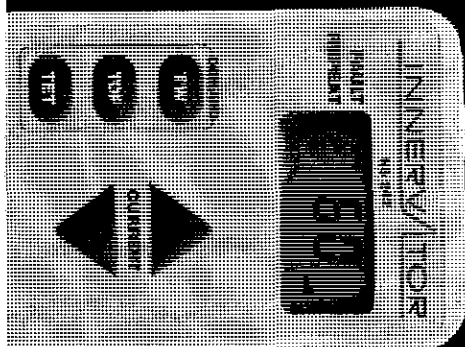


NS242

PERIPHERAL
NERVE STIMULATOR



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TABLE OF CONTENTS

INTRODUCTION	PAGE 4
PRECAUTIONS	PAGE 5
CONTROLS AND FUNCTIONS	PAGE 6
TEST PROCEDURE	PAGE 8
CONNECTION TO A PATIENT	PAGE 9
OPERATOR CONTROL BUTTONS	PAGE 11
VISUAL INDICATORS	PAGE 13
AUDIO INDICATORS	PAGE 15
ADDITIONAL FEATURES	PAGE 16
REPLACEMENT OF BATTERIES	PAGE 17
ACCESSORIES	PAGE 18
SPECIFICATIONS	PAGE 19

INTRODUCTION

Nerve stimulation is effected by the CURRENT passing through the tissue between electrodes, not by voltage. Therefore the pulse current characteristics are essential and primary. Unlike many other nerve stimulators, the INNERVATOR NS242 delivers a constant current stimulation pulse.

Skin resistance, electrode surface resistance, and gel conductivity vary widely. When using surface electrodes, constant current is the most effective way to achieve consistent supramaximal nerve stimulation. The voltage necessary to deliver the constant current must vary automatically with changing impedance, and the stimulating current pulse must be of sufficient intensity to achieve supramaximal stimulation.

The INNERVATOR NS242 is designed to deliver truly constant current pulses up to 80 milliamperes at up to 350 volts.

PRECAUTIONS

WARNING: Possible explosion hazard if used in the presence of flammable anaesthetics.
Risque d'explosion. Ne pas utiliser en presence d'anesthésiques inflammables.

The laws and statutes of many countries restrict this device to use by, or on the order of a physician.

This device should not be used in a manner which allows trans-thoracic stimulation.

This device should not be used for internal nerve location. Do not use with needle electrodes.

Dangerously high voltages may exist within this device for up to 10 minutes after removal of the batteries.

Triggering of this nerve stimulator may be caused by certain electrosurgical units (cauteries), which can generate high-energy random frequency noise. The NS242 has been designed with sensitive electronic circuitry to increase battery life and is totally compatible with "normal" operating room environments.

CONTROLS AND FUNCTIONS

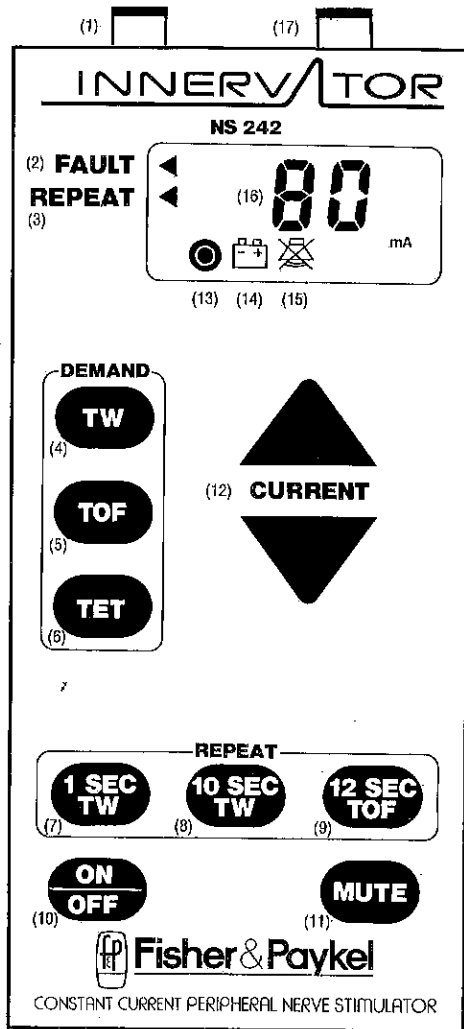
KEY

- (1) PROXIMAL — Positive (Red)
 (2) FAULT INDICATOR — Set current not delivered
 (3) REPEAT INDICATOR — Repetitive pulse pattern operating
 DEMAND BUTTONS — Deliver a pulse pattern on demand
 (4) SINGLE TWITCH
 (5) TRAIN OF FOUR
 (6) TETANUS

REPEAT BUTTONS — Activate a repetitive pulse pattern

- (7) 1 SECOND SINGLE TWITCH
 (8) 10 SECOND SINGLE TWITCH
 (9) 12 SECOND TRAIN OF FOUR
 (10) POWER ON/OFF BUTTON
 (11) MUTE BUTTON — Mutes pulse delivery sound
 (12) CURRENT UP/DOWN BUTTONS
 (13) PULSE DELIVERY INDICATOR
 (14) LOW BATTERY INDICATOR
 (15) MUTE SYMBOL — Audio pulse delivery sound muted
 (16) VISUAL DISPLAY OF SET OUTPUT CURRENT
 (17) DISTAL — Negative (Black)

FIGURE 1



TEST PROCEDURE

The following test procedure must be carried out each time the INNERVATOR is used, and before the instrument is connected to a patient.

1. Attach the lead to the INNERVATOR by inserting the colour coded right-angled banana plugs into the PROXIMAL (red) and DISTAL (black) output jacks.
2. Connect the free ends of the lead together to initiate a short circuit condition.
3. Switch the INNERVATOR on using the ON/OFF button. Set a delivery current of 10mA.
4. Activate a single twitch at 1 second intervals by selecting the appropriate REPEAT button (1 SEC TW). Both the audible and visual indicators should activate each time a pulse is delivered (every 1 second). The low battery indicator should not be shown on the display.

Emission of a **half second monotone beep** followed by a **continuous 2 second beep**, warns that the ends of the lead are not shorted together properly or that the lead is broken.

5. Whilst still running a 1 second repetitive single twitch, disconnect the ends of the lead to initiate an open circuit condition. This instigates alarm conditions and at the next attempt to deliver a pulse instead of hearing the normal audio pulse delivery sound, the operator should hear a half second monotone beep followed by a continuous 2 second tone. This procedure tests the high skin resistance alarm and the device's internal circuitry.
6. Once the test procedure has been completed ensure that the INNERVATOR is switched off.

CONNECTION TO A PATIENT

The following procedure should be utilised when connecting the INNERVATOR to a patient:

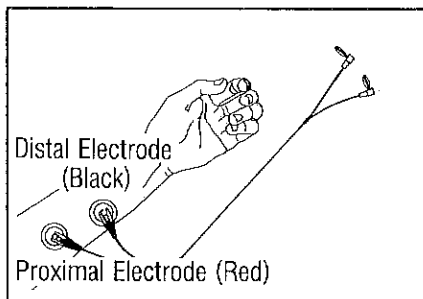
1. Ensure that the INNERVATOR is switched OFF. Power should be off during connection of the device to the patient to prevent unnecessary discomfort.
2. Place two standard ECG electrodes (disposable or reusable electrodes are suitable) on the skin of the forearm, along the course of the nerve to be stimulated. In most cases this is usually the ulnar nerve. (See figure 2).
3. Connect the lead to the INNERVATOR by inserting the right angled banana jacks into the PROXIMAL (red) and DISTAL (black) output jacks. The ends of the lead are colour coded so that colour matching will ensure that correct connections are made.
4. Connect the other end of the lead to the patient electrodes. The PROXIMAL (red) output jack is positive, and the DISTAL (black) output jack is negative. The lead should be connected with the proximal connector (red) attached to the proximal electrode, and the distal connector (black) attached to the distal electrode. If the leads are connected in this way then supramaximal stimulation is achieved by a somewhat lower current than if the leads are reversed.
5. **Following the induction of anaesthesia** switch the INNERVATOR on using the ON/OFF button, and then increase the current until observation of the twitch response indicates that the desired or supramaximal stimulation has been attained.

IMPORTANT: If a two second continuous tone is heard after the audible pulse delivery indicator this indicates that **alarm conditions exist**, and the current selected is not being delivered to the patient.

This may be caused by excessive impedance, dried or faulty electrode(s) or disconnected leads.

6. After use, always ensure that the INNERVATOR is switched OFF.

FIGURE 2



OPERATOR CONTROL BUTTONS

Buttons are grouped into three categories according to their function:

A. CONFIGURATION BUTTONS

ON/OFF On/Off button.



Switches the INNERVATOR on, and may be operated at any time to turn the INNERVATOR off instantaneously.

CURRENT UP Current Up button.



CURRENT DOWN Current Down button.

These buttons are used to set the amount of current to be delivered. They increase and decrease the current setting by 10 milliamperes (mA) steps each time the button is pressed. If the CURRENT UP button is held down, then the display quickly advances to 80mA. Similarly by holding down the CURRENT DOWN button the set current display quickly decreases to 0mA.

The INNERVATOR can not be set to deliver a current of more than 80mA.

MUTE Mute button.



- This button activates the mute function, which can be used to mute the audible pulse delivery sound. When the mute is in operation this is indicated by the mute symbol (⊗) on the display.

The mute remains in effect until the user pushes the MUTE button again to switch the mute off. The mute can only be used to mute the audible pulse delivery sound, it **cannot be used to mute the audio alarm sound**.

B. DEMAND BUTTONS

Buttons which will deliver a single pulse pattern on demand. When the button is pressed the pulse pattern will be delivered once only.

TW Twitch button.



Delivers a single pulse.

TOF Train-of-Four button.



Delivers a train of four pulses where each pulse is 0.5 seconds apart.

TET Tetanus button.



Delivers a tetanus pulse train for as long as the button is depressed.

C. REPEAT BUTTONS

These are start/stop buttons which activate a preset pulse pattern. The pulse pattern will play repeatedly until the button is pressed again to terminate the cycle. When any one of the three repeat pulse patterns below is in operation the visual REPEAT indicator (◀) is shown on the display.

1 SEC TW 1 Second Twitch button (1Hz).



Pressing this button causes a single pulse to be delivered at one second intervals. This pulse pattern will play repeatedly until the button is pressed again to halt the function.

10 SEC TW 10 Second Twitch button (0.1Hz).



Pressing this button causes a single pulse to be delivered at 10 second intervals. This pulse pattern will play repeatedly until the button is pressed again to halt the function.

12 SEC TOF 12 Second Train-of-Four button.



Pressing this button causes a train of four pulses to be repeated every 12 seconds. This pulse pattern will play repeatedly until the button is pressed again to halt the function.

VISUAL INDICATORS

The INNERVATOR NS242 has the following visual indicators: (see also Figure 3 overleaf)

CURRENT

mA

The current to be delivered to the patient is shown in milliamps and is indicated by the mA symbol.

PULSE DELIVERY



The pulse delivery indicator is shown as a solid dot in the centre of a circle. It flashes every time a pulse is delivered.

MUTE SYMBOL



This is a speaker with a cross through it and when visible it indicates that audible pulse signal is muted.

REPEAT SYMBOL



This is shown as a small triangular arrow and indicates that one of the three repeat pulse patterns 1 SEC TW, 10 SEC TW, or 12 SEC TOF is running.

FAULT SYMBOL



This is shown as a small triangular arrow and indicates that the INNERVATOR is not able to deliver the specified current and alarm conditions exist. The fault indicator may be activated by conditions of excessive impedance, if the leads are disconnected or if the patient electrodes are dry.

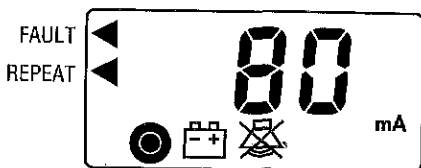
LOW BATTERY



This is shown as a picture of a battery and indicates that the batteries are becoming flat and must be replaced shortly. The INNERVATOR will continue to operate normally for a short time. If the batteries are not replaced eventually the display will become completely blank except for the low

battery symbol. Once this has occurred the INNERVATOR can only be operated by replacing the batteries.

**Figure 3 — Visual Indicators
Displayed By The INNERVATOR NS242**



AUDIO INDICATORS

The INNERVATOR NS242 has the following audible indicators:

PULSE DELIVERY

This is heard as a monotone single beep every time a pulse is delivered.

AUDIBLE ALARM

Heard as a half second monotone beep each time a pulse is delivered incorrectly, AND at the completion of the pulse train there is a 2 second continuous beep indicating that alarm conditions exist.

This is heard every time the INNERVATOR delivers a pulse that does not fall within the $\pm 5\text{mA}$ tolerance limits each side of the set current. The conditions causing this alarm may include excessive impedance, disconnected leads or dry patient electrodes. The alarm sound is NOT continuous and will only be heard each time an attempt is made to deliver a pulse.

The alarm sound will be cancelled automatically when the condition causing the alarm is repaired.

THERE IS NO ALARM MUTE FACILITY

If the alarm sound is occurring repeatedly:

- do not continue running a repeat function.
- do not deliver any further pulses until the fault causing condition is repaired.

ADDITIONAL FEATURES

Auto power shut-off.

The INNERVATOR will automatically switch off after 20 minutes of non-use. Prior to power shut-off the INNERVATOR will emit three beeps, and if no buttons are pressed within the next one minute the INNERVATOR will automatically switch off. Pressing any button other than the ON/OFF button will cancel the automatic shut down for another 20 minutes.

This feature is designed to safeguard against rapid battery deterioration if the INNERVATOR is accidentally switched on, or is left turned on.

Automatic shutdown will not occur if the operator is running a repeat function.

This feature also serves to remind the user that monitoring has not been undertaken for at least 20 minutes.

REPLACEMENT OF BATTERIES

The INNERVATOR NS242 is powered by three 1.5 volt AA batteries.

Batteries should be replaced when the low battery indicator () is first observed on the LCD display.

To replace the batteries, simply depress the clip on the top rear of the INNERVATOR by pushing it down towards the bottom of the back panel. Batteries should be inserted observing the correct polarity as indicated on the inside of the battery cover.

ACCESSORIES

The following part numbers should be quoted when ordering peripheral nerve stimulators and accessories:

NS242 Constant Current Peripheral Nerve Stimulator

Complete with nerve stimulator lead 200NS007 and operating manual. Batteries not included.

200NS001 Diagnostic Probe

200NS002 Carry Case

Nylon, shock resistant, zippered carry case with belt loop. Colour - grey.

200NS003 Disposable Electrodes *\$2.15*

Adhesive, dual element perforated electrode with pregelled soft foam pad. One dual element (two domed electrodes) per pack. Connect using nerve stimulator lead 200NS007.

200NS004 Reusable Electrodes *\$110*

Black silicone rubber electrode, 51x38mm (2x1.5 inches). Non-adhesive. Pack of 10 electrodes. Connect using nerve stimulator lead 200NS008.

200NS007 Nerve Stimulator Lead

1.2m (48") with alligator clips. For use with disposable electrodes 200NS003. Colour coded ends.

200NS008 Nerve Stimulator Lead

1.2m (48") with 2mm pin connectors. For use with reusable electrodes 200NS004. Colour coded ends.

200NS009 Mounting Bracket

185040541 NS242 Operating Manual

185040547 NS242 Technical Manual

SPECIFICATIONS

Output current range	0-80milliamperes, selectable in 10mA steps
Tetanus frequency	50Hz
Output pulse form	Square wave, constant current, monophasic, unidirectional
Output pulse width	200 microseconds, +/- 5 microseconds
Output pulse rise/fall time	<5 microseconds
Output voltage	350 volts, maximum
Set current offset	<5 milliamperes
Alarm tolerance limits	+/- 5mA of the set current
Power requirement	Three 1.5 volt "AA" batteries
Battery life	More than 300 hours continuous use with alkaline batteries
Dimensions	Height - 160mm Width - 73mm Depth - 43mm Weight - 0.18kg (without batteries)

To display or record the voltage, connect an oscilloscope directly to the output jacks of the instrument. To record the current delivered, a small precision resistor must be connected in series with the patient. The oscilloscope must be connected across this resistor.